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INFLUENCE OF INTERCROPPING AND NUTRIENT MANAGEMENT PRACTICES ON INSECT PEST POPULATION OF TRADITIONAL RED RICE

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ABSTRACT

A field experiments were conducted at wet land farm of Agricultural college and research institute, Madurai during rabi 2014-2015 to find out the influence of green manure (Sesbania acculilata) inter cropping with three different nutrient levels on four red rice varieties, of which two traditional varieties (Chandikar and Nourguan) and two improved red rice varieties (TKM 9 and TPS 1) pest and disease incidence and its population. All four red rice varieties are found to infect with rice thrips and stem brorer. Thrips were found in initial stage of crop in all the varieties and stem brorer was also found in all red rice varieties but the incidence was high in TKM 9 when compared with other three varieties. The thrips and dead heart symptoms of stem broer was not significantly influenced by nutrient management and drum seeding, whereas white heads at 50 DAS had a significant effect on white head of stem borer incidence. In this study it's observed that all varieties are free from all other rice major insect pest and diseases.

KEYWORDS: Influence of Green Manure, Pest and Disease Incidence & Stem Borer Incidence

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INTRODUCTION

Rice is a major contributor to the human food supply of the world and Asia accounts for 90% of the production and consumption of rice. In India, rice occupied 39.16 million hectares area with a production of 85.59 million tonnes and average productivity of 2.2 t ha^{-1} (Gill *et al.*, 2014). Rice varieties with a red bran layer are called red rice. Several varieties of rice are having appealing red color. The colour is confined to the bran layer, a tinge of red remains even after a high degree of milling. The colour of the bran ranges from light red to dark red. Red rice was considered as highly nutritive and medicinal. The rice is eaten as whole grain. The zinc and iron content of red rice is 2-3 times higher than that of white rice (Krishnaprabu 2013).Besides these red rice varieties are found to resistance against pest and disease. In Asia, transplanted rice has been replaced by dry seed broadcasting, mainly because of the higher cost of transplanted rice and shortage of labour (Dileep Kachroo, 2006).

Drum seeding of pre-germinated rice seeds with green manure (*Sesbania aculeata*) and *in-situ* incorporation of green manure supply the nitrogen to the rice during the peak nutrient requirement stages and also the presence of one species on others modify the environment of crops which leads to change in pest population. Nutrition management is one of the most important practices for high production system, but nutrition management may affect response of rice to pests, as well as development pattern of pest populations due to the change of environments. The understanding of impacts of nutrition management on interactions between rice and pests is a basis to stimulate high yield production system. Most pest management methods used by farmers can be considered as soil fertility management strategies and vice-versa. There are positive interactions between soil fertility and pest and disease always exists. To understand the relationship between intercropping and nutrient management practices

on pest disease incidence this study was taken up in traditional and improved red rice varieties.

MATERIALS AND METHODS

Field experiment was conducted in the wetlands of Department of Agricultural College and Research Institute, Madurai during *rabi* season of 2014-2015. The design adapted was split-split plot and replicated thrice. Main plot with four red rice races of which two traditional cultivars (V_1 - Chandikar and V_2 - Norungan) and two improved red rice varieties (V_3 - TKM 9 and V_4 - TPS 1). In sub plot two different wet seeding under puddled condition (S_1 - Rice + Daincha (*Sesbania aculeata*) and S_2 - Rice alone) using TNAU model rice cum daincha drum seeder and in sub sub plot three nutrient levels *viz.*, N_1 - 75 % of Recommended Dose of Fertilizer (RDF) N_2 - 100% RDF and N3- 125% RDF. 50:25:25 kg NPK ha^{-1} of recommended dose was applied in split viz., 50% of N and K and full of P was applied as a basal dose remaining applied at 30 Days After Sowing (DAS).

Grown green manure was *in-situ* incorporated in soil using cono weeder at 30 DAS. 3-4 field investigations were carried out at tillering stage, elongation stage, booting stage and flowering stage and the methods adopted according to pest species and disease incidence. Thirps (*Stenchaetothrips biformis*) was found in initial crop growth stage and population load was counted by 12 swipes in wet fames as the method suggested by Chandramani 2003 on 25 DAS. Stem borer (*Scirpophaga incertulas*) population count was taken by collecting injury plants and recorded separately based on the symptoms, tillers with dead hearts, and white heads. Dead heart symptom appear only in initial crop stage and recorded on 25 days after sowing and it was rated based on rating scale. White ear head damage was recorded at reproductive stage and rated as rating scale given by Kavitha and Dharna reddy, 2015. Per cent of dead hearts and white heads was calculated as per the following formula:

$$\% \text{ dead hearts} = \frac{\text{No. of dead hearts counted}}{\text{Total no. of tillers observed}} \times 100$$

$$\% \text{ white heads} = \frac{\text{No. of white heads}}{\text{Total productive tillers}} \times 100$$

To assess the incidence of other pest *viz.*, gall midge, brown planthopper, green leafhopper and white backed planthopper and disease like blast and bacterial blight periodical observations was made.

RESULTS AND DISCUSSIONS

Thrips (Table 1)

Thrips in rice was important pest in rice nursery, whereas in direct seeding of rice the incidence thrips was found in main field in early growth stages of crop. Different nutrient management and crop establishment methods not showed any significance difference in thrips incidence of red rice at 25 DAS. But it was observed that the numerical difference in thirps population on red rice with intercropping and nutrient management practices. The red rice variety Chandikar (V_1) recorded with lower thrips incidence of 43.7 numbers per 12 passes when comparing with all other varieties. This might be due to genetic resistance of land races against various pests and disease. The similar result was opined by Das and Das (2014) in different land races.

Green manure *Sesbania* intercropping also not showed any significance on thrips population. The reduced thrips incidence (44.7 numbers per 12 passes) was reported in rice with danicha intercropping (S_1). *Sesbania* inter cropping might also be reduced the pest incidence by interfere directly with activities of the pest and change the environment by the presence of intercrop, So that natural enemies of the pests was favored. These results also corroborate with Trenbath, 1993.

There was no significant difference observed in thrips population under different fertilizer application to red rice. Numerically maximum thirps population of 47.2 numbers per 12 passes was recorded in 125% RDF application (F3) and lower thirps pupation of 42.2 numbers per 12 passes was found in 75% RDF application. This may be due to low nutrient response characteristic of land races. In contrast application nitrogen fertilizer at 100% RDF was increased thrips incidence in crop was reported by Chandramani, 2003 in MDU 5 rice variety. The interaction of treatments does not reflect significant difference in thrips incidence.

Stem Borer (Table 2)

Intercropping and different nutrient management practices in traditional red rice varieties had not showed any significant difference in stem borer incidence by producing dead heart and white head symptoms. During initial crop growth stages the dead heart symptoms are appeared in all the treatment combinations, whereas the level of incidence of stem borer was below economic thresh hold level. Numerically maximum per cent of dead heart and white head symptoms was appeared in variety TKM 9 with 8.4 and 6.83 per cent respectively. This might be due to morphological characteristics like presence or absence of awns and leaf characteristics of land races. Similarly number of land races resistance to pest reported by Jain *et al*. (2004) and Semwal *et al*. (2015).

Drum seeding of rice cum *Sesbania* recorded numerically lower per cent of dead heart and white head symptoms (7.4 and 5.22 per cent). This might be due to interference of inter cropping with the capacity of pests to colonize hosts by imposing physical barriers, disrupting olfactory and visual cues, and creating diversions to non-crop hosts and interception of incoming radiation is one of the most important parameter that influences the microclimate. The similar result was indicated by Teasdale *et al*. (2004).

The nutrient management practices had a significant effect on white heads but not in dead heart symptoms. Application of 75% RDF in two split dose significantly reduced white head incidence (4.71%) of red rice and this was on par with 100 and 125% RDF application. This was due to plants receiving higher amounts of nitrogen have less silication of epidermal cells and thus lower resistance to herbivores and also the application of nitrogen also reduces hemicellulose and lignin in the cell wall and weakens plants. Similar results also reported by Chandramani, 2003 in MDU 5 rice variety at 45 and 70 days after transplanting. Randhawa, and Aulakh (2014) also reported that the increase in stem borer incidence in basmati rice. The interaction effects also not showed any significant difference.

Other Major Pest and Disease

This field trail reveled that all the four red rice varieties in both crop establishment techniques and with different nutrient management practices was free from other pest (Gall midge, Brown planthopper, green leafhopper and White backed planthopper) and major diseases like Blast and bacterial blight.

CONCLUSIONS

From this study it was concluded that the traditional red rice varieties *viz.*, Chandikar, Norungan TKM 9 and TPS

1 are resistance to major pest and disease of rice. Even the incidence thirps and stem borer was noticed, but level of incidence was well below the economic thresh hold level and per cent incidence was scored at highly resistance rate. These varieties can also be used for organic farming where the organic pest and disease management was difficult.

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APPENDIX

Table 1: Effects of Green Manure Inter Cropping and Nutrient Management Practices on Thirps Population (No. /12 Passes) of Red Rice (20 DAS)

Treatments	F_1	F_2	F_3	Mean
V_1	40.0(6.5)	43.7(6.7)	47.3(7.0)	43.7(6.7)
V_2	43.5(6.7)	45.0(6.9)	46.2(6.9)	44.9(6.8)
V_3	42.8(6.7)	46.5(7.0)	48.5(7.1)	45.9(6.9)
V_4	42.3(6.6)	44.7(6.8)	47.0(7.0	44.7(6.8)
Mean	42.2(6.6)	45.0(6.8)	47.2(7.0)	
S_1	41.8(6.6)	45.8(6.9)	46.3(6.9)	44.7(6.8)
S_2	42.5(6.7)	44.1(6.8)	48.2(7.1)	44.9(6.8)
Mean	42.2(6.6)	45.0(6.8)	47.2(7.0)	
V_1S_1	42.3(6.6)	44.0(6.8)	47.3(7.0)	44.6(6.8)
V_1S_2	42.3(6.7)	45.3(6.9)	46.7(7.0)	44.8(6.8)
V_2S_1	44.3(6.8)	44.7(6.8)	51.7(7.3)	46.9(7.3)

V_2S_2	41.3(6.6)	48.3(7.1)	45.3(6.9)	45.0(6.9)
V_3S_1	43.7(6.8)	45.7(6.9)	45.3(6.9)	44.9(6.8)
V_3S_2	43.3(6.7)	44.3(6.8)	47.0(7.0)	44.9(6.8)
V_4S_1	39.7(6.4)	42.0(6.6)	48.3(7.1)	43.3(6.7)
V_4S_2	40.3(6.5)	45.3(6.9)	46.3(6.9)	44.0(6.8)
Mean	42.2(6.6)	45.0(6.8)	47.2(7.0)	
	Sed		CD (p=0.05)	
V	NS		NS	
S	NS		NS	
F	NS		NS	
V × S ×F	NS		NS	

$$( ) = \sqrt{X + 0.5}$$

Table 2: Effect of Green Manure Inter Cropping and Nutrient Management Practices on Stem Borer Incidence of Red Rice

Treatments	% Of Dead Heart At 25 DAS				% Of White Head At 50 DAS			
	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean
V_1	6.5 (2.91)	7.2 (3.02)	8.2(3.17)	**7.3(3.03)**	3.83(2.40)	4.50(2.54)	5.00(2.64)	**4.44(2.53)**
V_2	6.5(2.88)	7.5(3.07)	8.5(3.24)	**7.5(3.06)**	3.83(2.41)	5.17(2.67)	5.83(2.80)	**4.94(2.63)**
V_3	8.0(3.15)	8.5(3.24)	8.8(3.29)	**8.4(3.23)**	6.67(2.94)	7.67(3.11)	6.17(2.83)	**6.83(2.96)**
V_4	7.3(3.05)	7.7(3.11)	8.5(3.21)	**7.8(3.12)**	4.50(2.54)	6.33(2.88)	5.83(2.78)	**5.56(2.73)**
Mean	**7.1(3.00)**	**7.7(3.11)**	**8.5(3.23)**		**4.71(2.57)**	**5.92(2.80)**	**5.71(2.76)**	
S_1	6.8(2.95)	7.5(3.07)	7.9(3.13)	**7.4(3.05)**	4.33(2.50)	5.67(2.76)	5.67(2.75)	**5.22(2.67)**
S_2	7.3(3.04)	7.9(3.14)	9.1(3.32)	**8.1(3.17)**	5.08(2.65)	6.17(2.84)	5.75(2.77)	**5.67(2.75)**
Mean	**7.1(3.00)**	**7.7(3.11)**	**8.5(3.23)**		**4.71(2.57)**	**5.92(2.80)**	**5.71(2.76)**	
V_1S_1	6.7(2.93)	7.7(3.10)	9.7(3.40)	**8.0(3.14)**	3.33(2.30)	4.33(2.51)	4.67(2.57)	**4.11(2.46)**
V_1S_2	6.3(2.88)	6.7(2.93)	6.7(2.94)	**6.6(2.92)**	4.33(2.51)	4.67(2.58)	5.33(2.71)	**4.78(2.60)**
V_2S_1	6.3(2.85)	7.3(3.05)	8.7(3.26)	**7.4(3.05)**	3.33(2.31)	4.67(2.58)	5.33(2.71)	**4.44(2.53)**
V_2S_2	6.7(2.91)	7.7(3.10)	8.3(3.21)	**7.6(3.07)**	4.33(2.52)	5.67(2.76)	6.33(2.88)	**5.44(2.72)**
V_3S_1	8.3(3.21)	8.7(3.27)	9.3(3.37)	**8.8(3.28)**	6.33(2.89)	7.33(3.05)	8.33(3.21)	**7.33(3.05)**
V_3S_2	7.7 (3.09)	8.3(3.21)	8.3(3.21)	**8.1(3.17)**	7.00(3.00)	8.00(3.16)	4.00(2.45)	**6.33(2.87)**
V_4S_1	8.0(3.16)	8.0(3.17)	8.7(3.27)	**8.2(3.19)**	4.33(2.51)	6.33(2.88)	4.33(2.51)	**5.00(2.63)**
V_4S_2	6.7(2.93)	7.3(3.05)	8.3(3.16)	**7.4(3.05)**	4.67(2.57)	6.33(2.87)	7.33(3.04)	**6.11(2.83)**
Mean	**7.1(3.00)**	**7.7(3.11)**	**8.5(3.23)**		**4.71(2.57)**	**5.92(2.80)**	**5.71(2.76)**	
	Sed		**CD (p=0.05)**		**Sed**		**CD (p=0.05)**	
V	NS		NS		NS		NS	
S	NS		NS		NS		NS	
F	NS		NS		0.05		0.11	
V × S ×F	NS		NS		NS		NS	

$$( ) = \sqrt{X + 0.5}$$